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Silver, gold and PGMs: An example of life cycle sustainability

„Critical Metals: Recycling & Recovery – A Way Forward" Conference

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London, 18th of March 2013

Agenda

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- Introduction
- Applications and recycling rates
- Refining PGMs
- Room for improvement
- Conclusions

Status quo recycling rates

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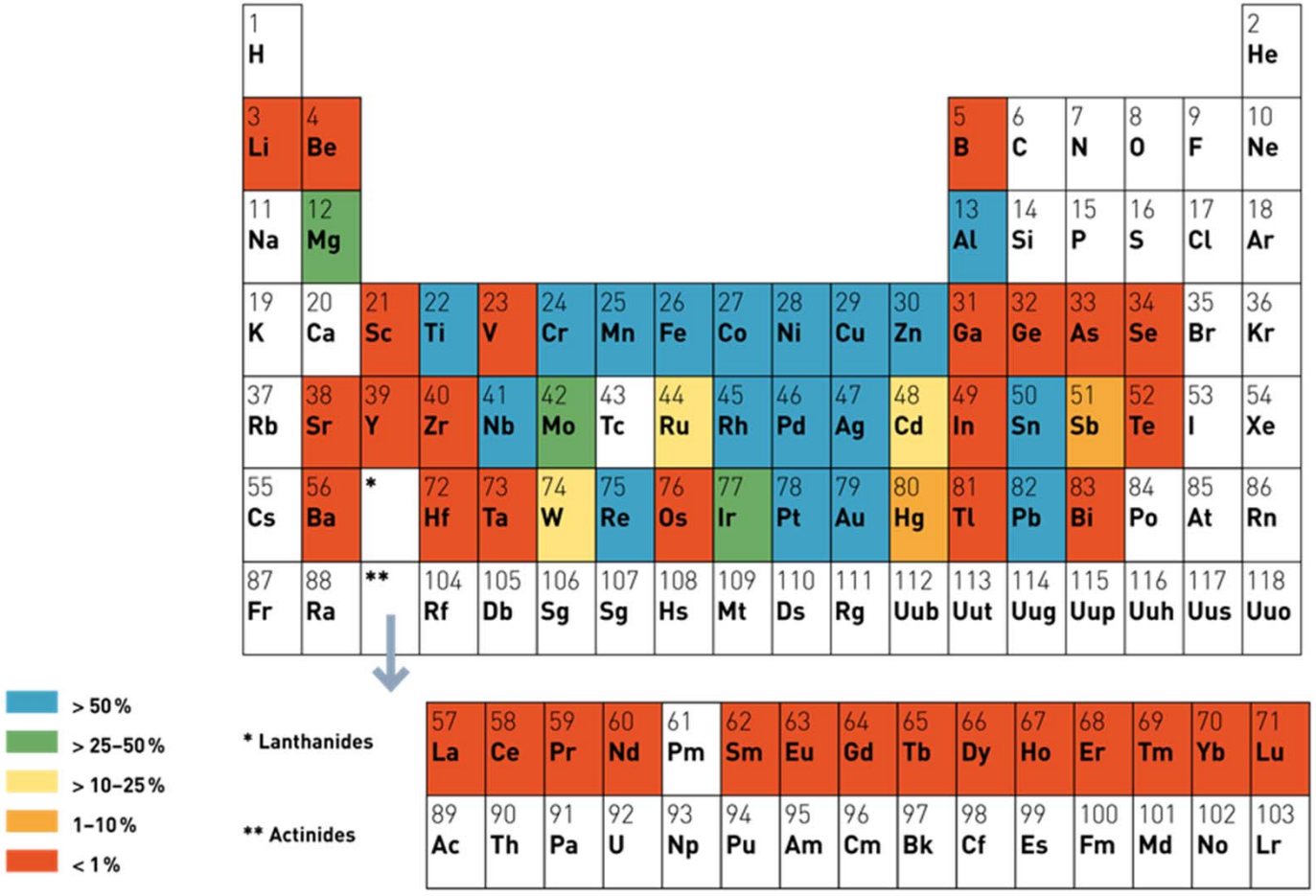
Global End-of-Life recycling rates of 60 metals (Graedel et al. 2011)



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Collection and recycling rates Platinum

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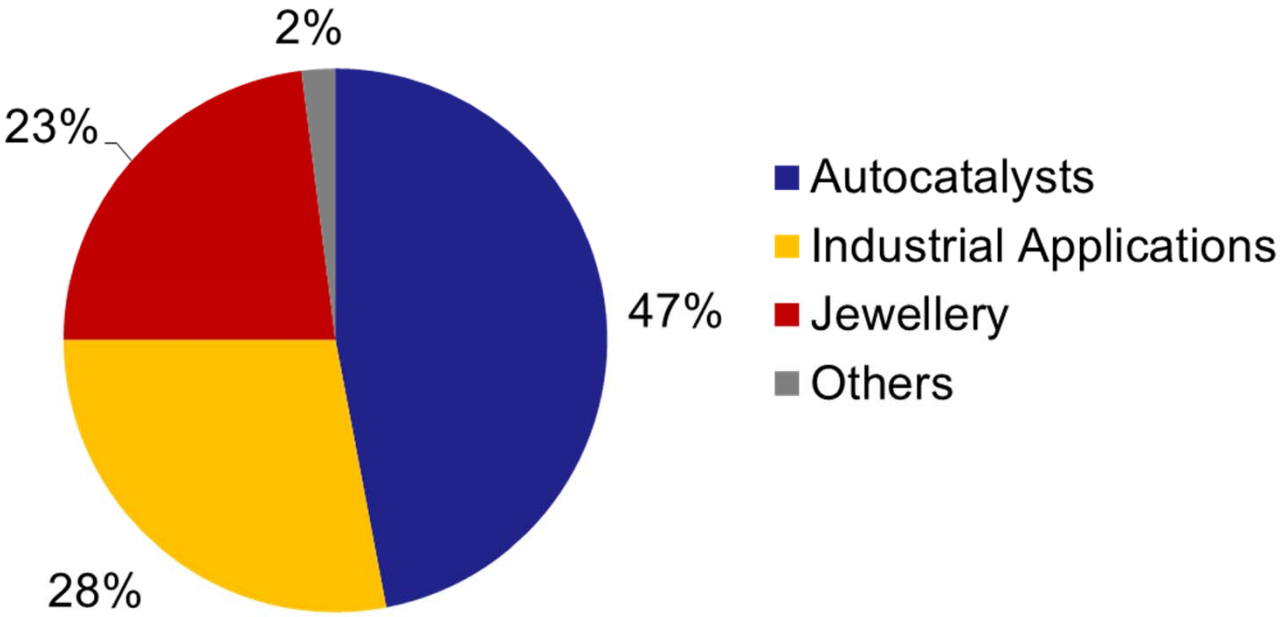
Platinum Applications



Global EoL recycling rate of platinum 60-70%

- **Autocatalysts 50-55%**
- **Industrial Applications 80-90%**
- **Jewellery 90-100%**

Source: Graedel et al 2011, Recycling Rates of Metals; Buchert et al 2009, Critical metals for future sustainable technologies and their recycling potential

Collection and recycling rates Palladium

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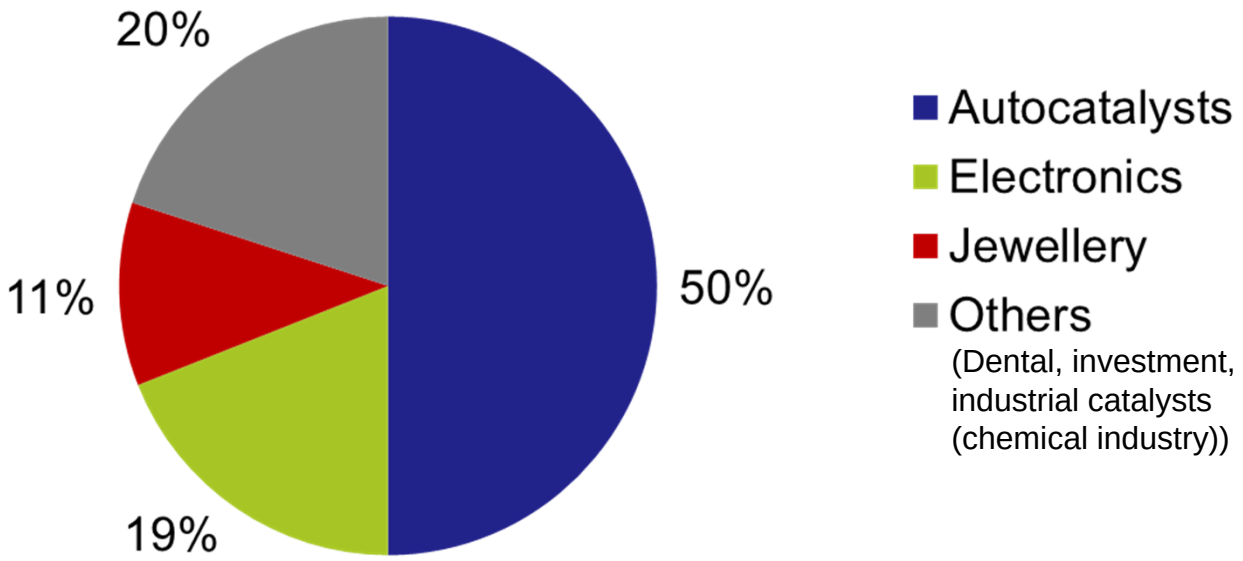
Palladium Applications



Global EoL recycling rate of palladium 60-70%

- **Autocatalysts 50-55%**
- **Industrial Applications 80-90%**
- **Jewellery 90-100%**
- **Electronics 5-10%**

Source: Graedel et al 2011, Recycling Rates of Metals; Buchert et al 2009, Critical metals for future sustainable technologies and their recycling potential

PGM-flows of Pt/Pd catalysts used in the oil refining industry

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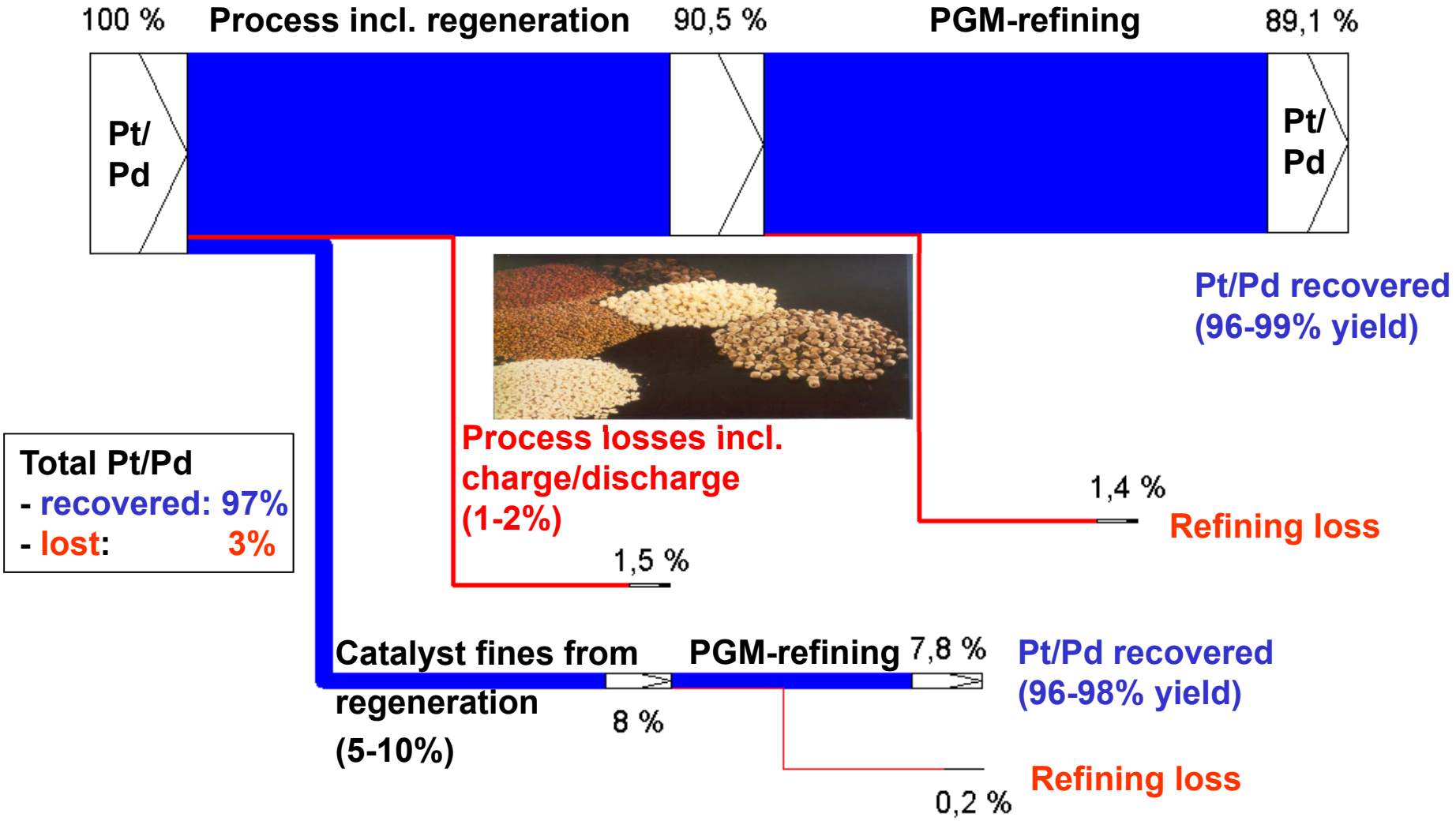

all %-numbers at single flows refer to 100% initial material; refining yields on input into PGM refinery

Source: Buchert, Hagelüken, Stahl: Materials flow of platinum group metals, GFMS 2005

Direct Recycling Loops

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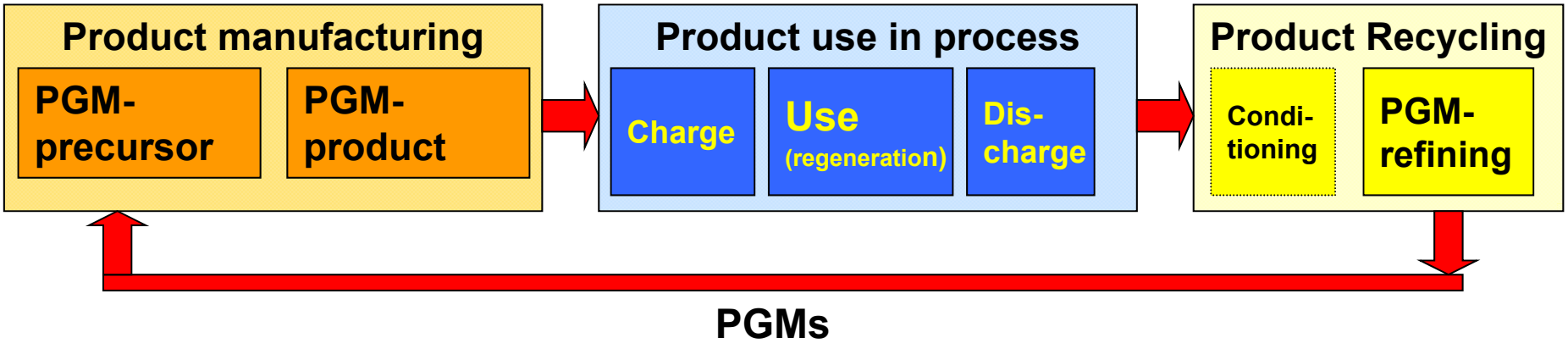

E.g. Oil-refining catalysts, chemical catalysts, glass-equipment

- Direct relationship along lifecycle (manufacturer, industrial user, PGM-refiner)
- No change of PGM-ownership after initial delivery to end user (weight account transfer)
- Industrial parties, professional handling, transparent material flows
- PGM content of product is known through entire cycle
- High PGM recycling ratio (usually > 90%)

Indirect Recycling Loops

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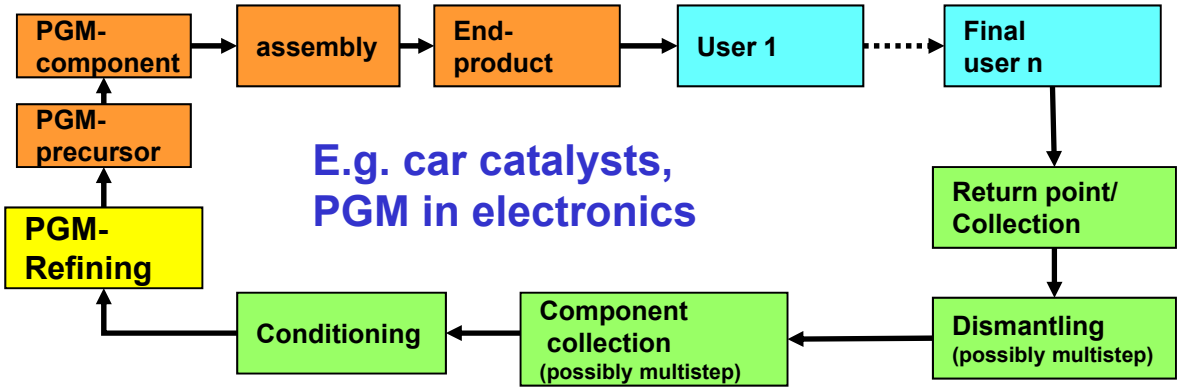

- No direct business relations between industrial parties involved, loop is broken by private end-users and non-industrial parties
- Multiple changes of PGM-ownership, component value fluctuates with PGM-prices
- No professional handling along entire chain, intransparent material flows after production, “grey and black channels” occur in end-of-life and scrap chain
- PGM lifecycle losses difficult to detect, information on PGM-content gets lost
- In certain areas dilution of PGM in end product to an extend, that recycling is not economically viable by itself (electronics)
- Lower PGM recycling ratio

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Copper and precious metals: a love story

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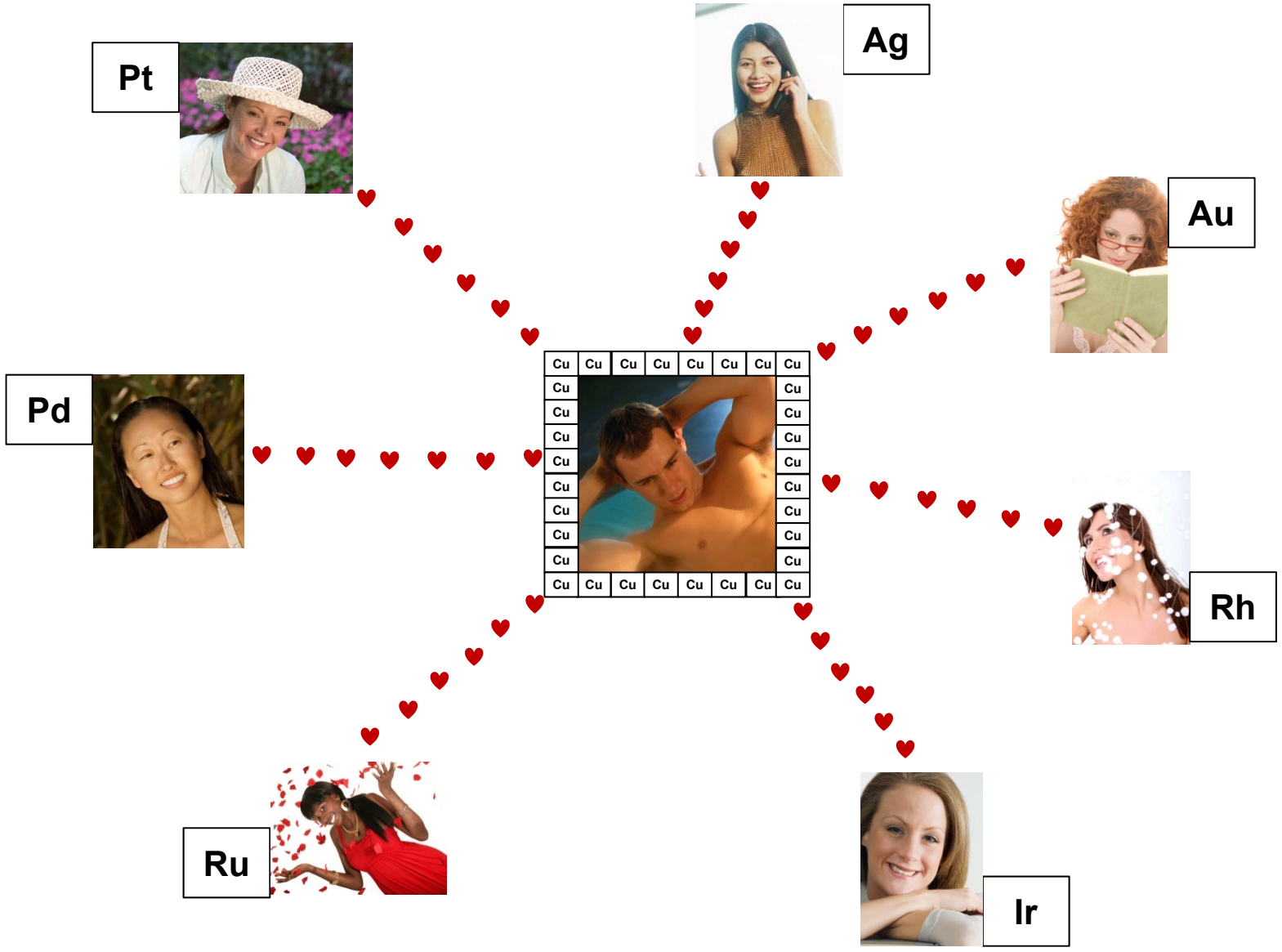

Recovery precious metals

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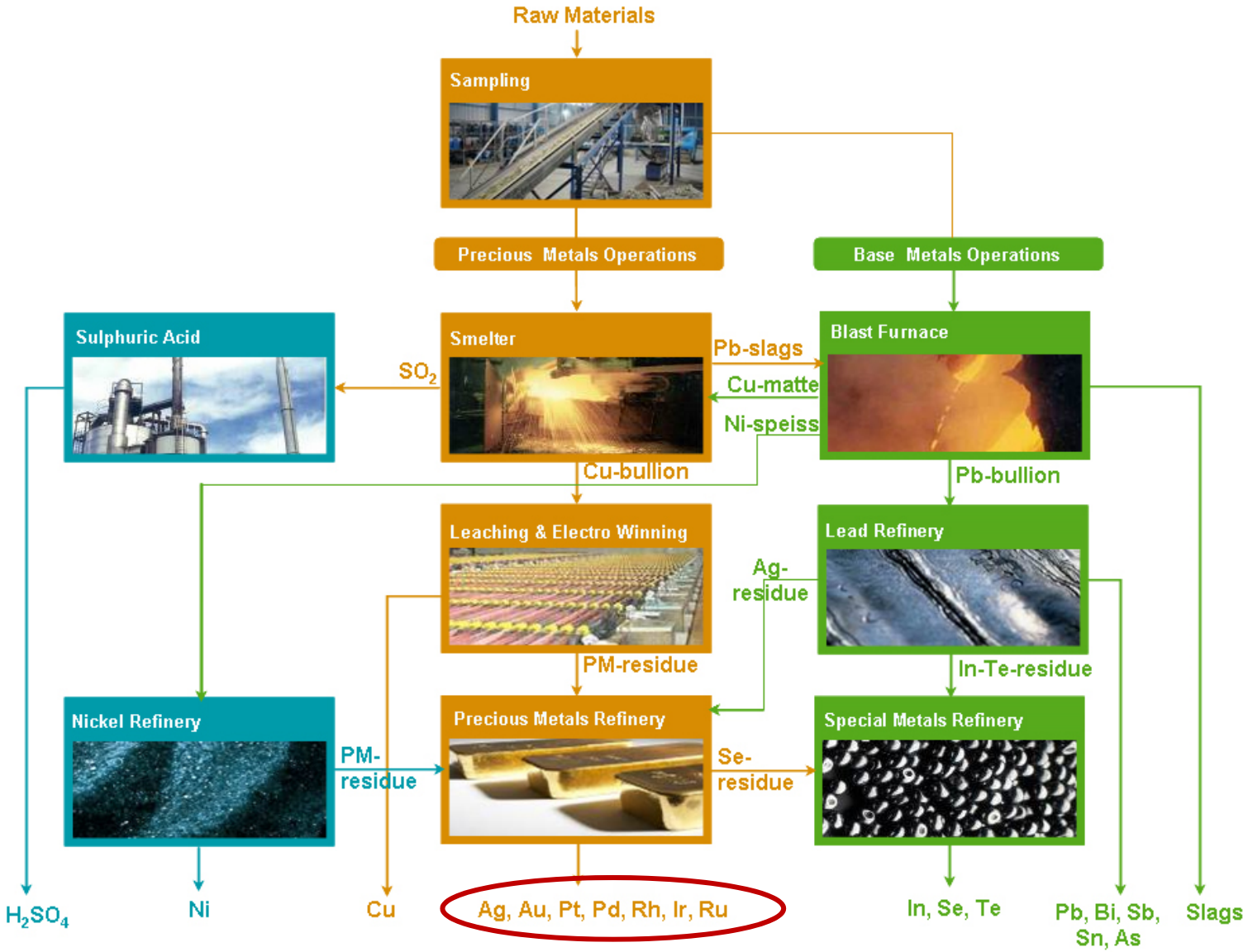
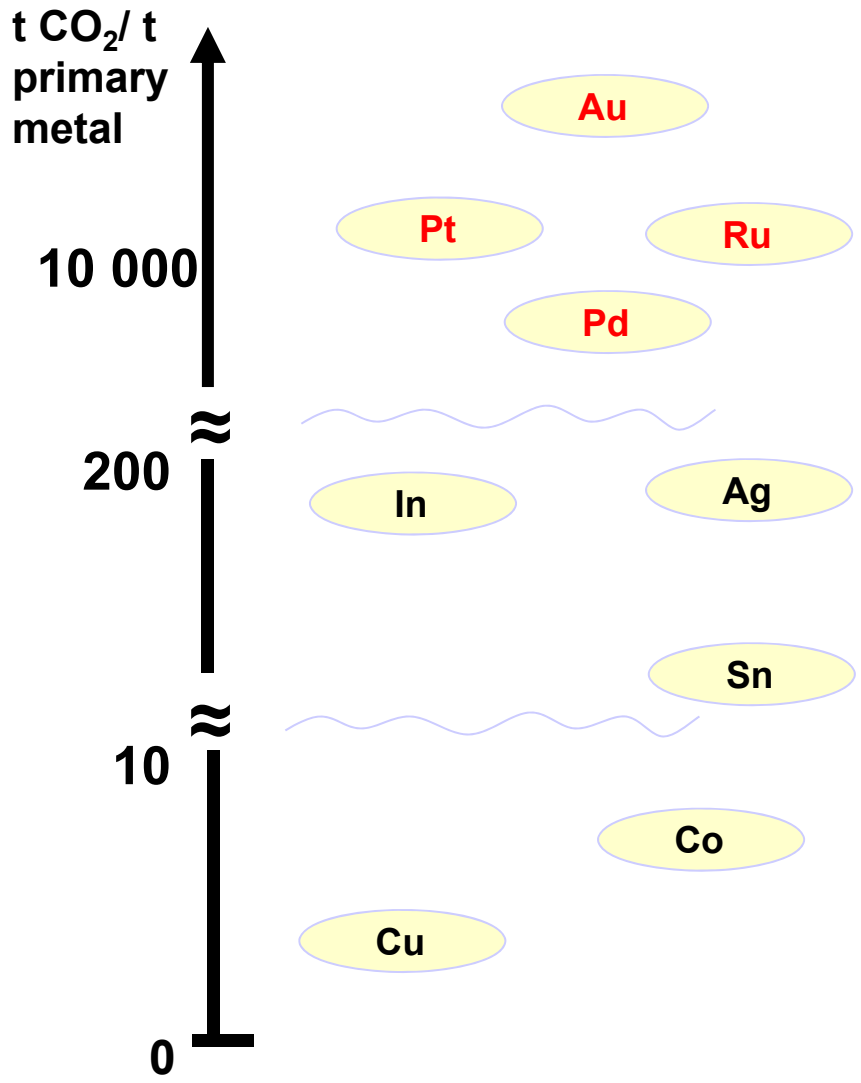


Process scheme Hoboken/Umicore (courtesy of Umicore Precious Metals Refining)

Environmental impact primary production precious metals



Additional impacts: SO_2-emissions, land use, sewage, etc.

source: ecoinvent 2.0, EMPA/ETH-Zürich, 2007

Urban mining – Recycling supports supply

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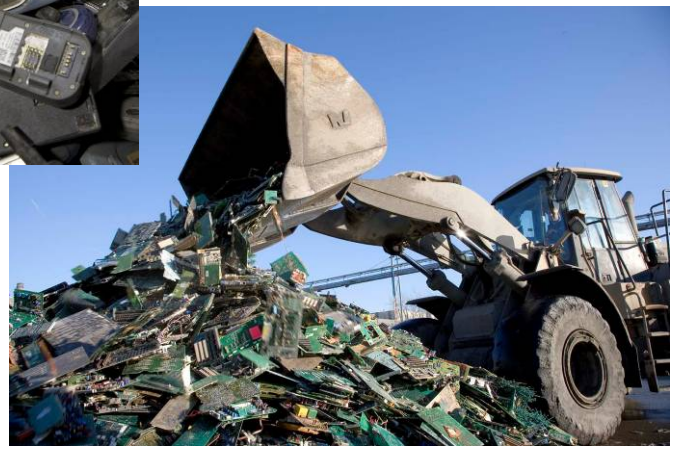
primary production ≈5 g/t Au in ore

Kalgold Gold Mine, South Africa
source: www.mining-technology.com

recycling ≈250 g/t Au in printed circuit boards



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Improving recycling structures in developing countries

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Pilot project:
Global Circular Economy of Strategic Metals - Best-of-two-Worlds Approach (Bo2W)

Partners:
Oeko-Institut, partners from industry like Umicore and VAC, local project partners in Ghana and Egypt

Further information about this project you can find on:
http://www.resourcefever.org/project/items/global_circular_economy_of_strategic_metals.html

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Currently, critical metals are lost…

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source: A.Manhart, Oeko-Institut

…with threat to environment and health

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source: A.Manhart, Oeko-Institut

The Challenge

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The Challenge is

- **creating higher economic and social values**
- **improving working conditions and reducing environmental and health impacts**
- **closing material cycles for valuable metals**
- **The focus of the project: WEEE and EoL-vehicles**

source: A.Manhart, Oeko-Institut

The Bo2W Approach

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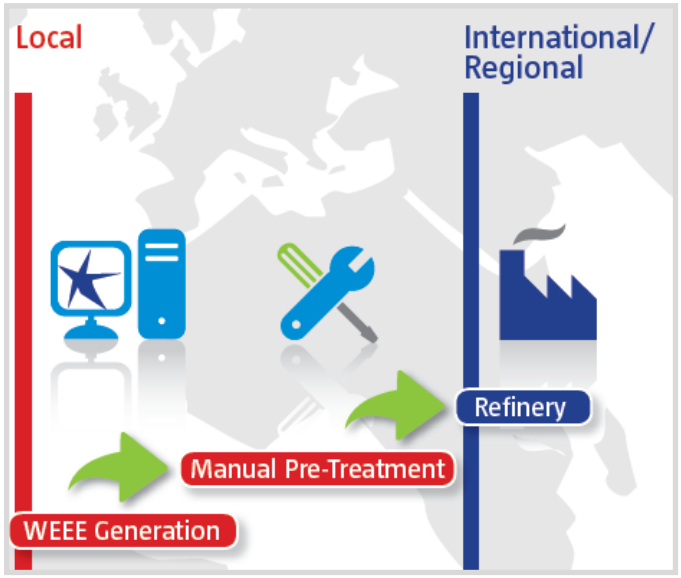
International co-operation to combine strengths of recycling systems in developing countries with those of industrialised countries



Benefits:

- Improved management of hazardous substances
- Increased resource efficiency / closed material cycles
- Reduced GHG emissions
- Growing income and employment generation in Ghana and Egypt
- Increasing investments in social & environmental standards

The Bo2W Approach

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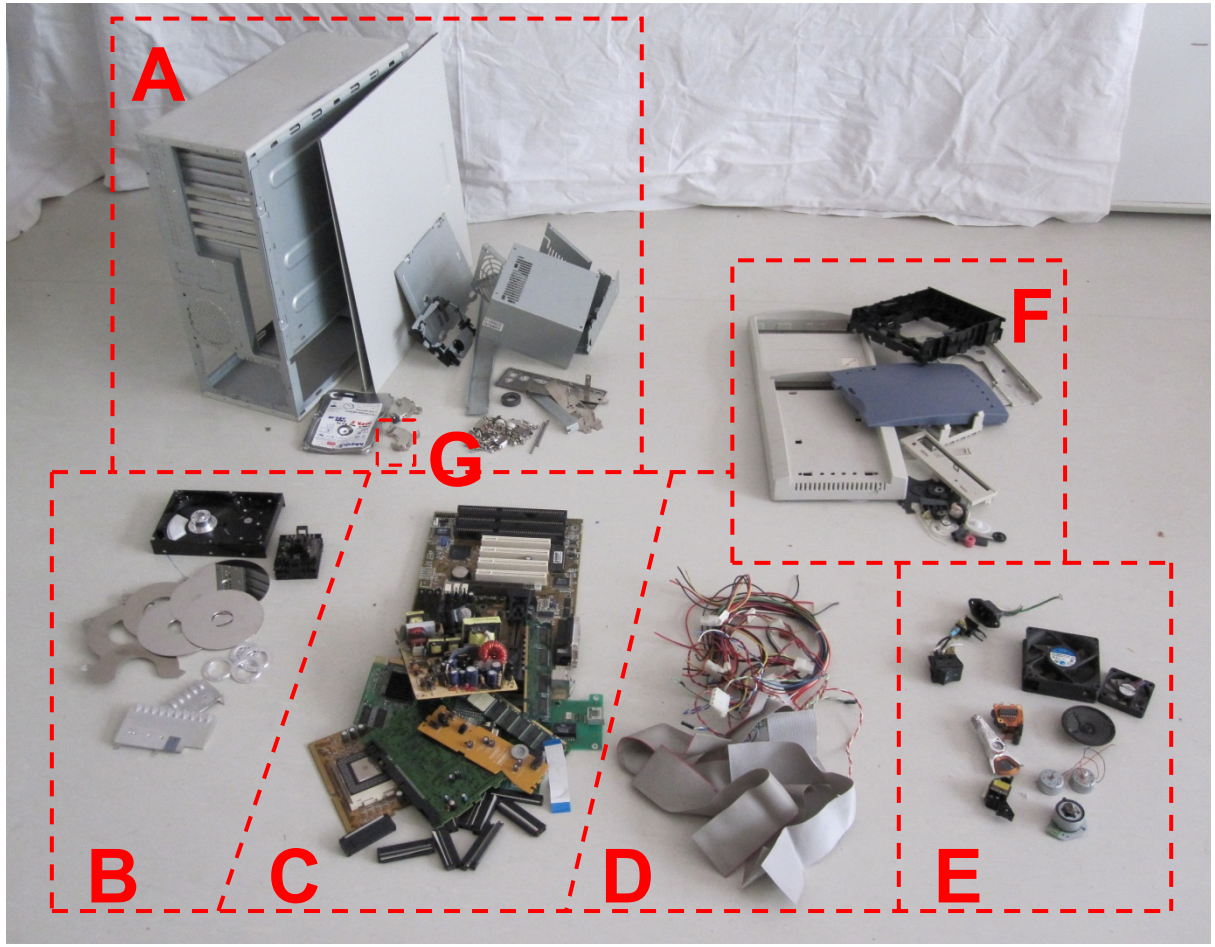
Example:
Solution for Information and Communication Technologies (ICTs): the key factor is careful dismantling and separation



A: Steel scrap
B: Aluminium scrap
C: Printed circuit boards
D: Cables
E: Copper-steel scrap
F: Plastics
G: Magnets

source: A.Manhart, Oeko-Institut

Developing Sound Recycling

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source: A.Manhart, Oeko-Institut

Project Outline

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- Duration of the project: June 2012 – May 2015
- Partners will be 2 to 3 times per year in Ghana and Egypt for continuous consultation to stakeholders like dismantling companies, NGO´s, authorities
- Stakeholder Workshops will take place in May / June 2013
- Final event will be in spring 2015
- On-going networking with stakeholders in Africa and Europe

Benchmark for the project success:
Valid, fair and sustainable recycling co-operations are launched and should be deepened and broadened in Ghana and Egypt

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Conclusions

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- The refining of precious metals achieves very high recovery rates in state of the art plants: >95%
- Serious losses of precious metals occur mainly due to weak collection rates from consumer electronics and inappropriate pre-treatment procedures
- Better international cooperation between stakeholders in industrial and developing countries will lead to room for improvement regarding the global EoL recycling rates: Bo2W-approach
- The very high values of precious metals could push the global EoL recycling rates of precious metals to even higher percentages compared to the status quo
- Enhanced EoL recycling rates will reduce the overall environmental impacts of the increasing global demand for precious metals

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More information on

www.resourcefever.org

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Thank you for your attention!

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